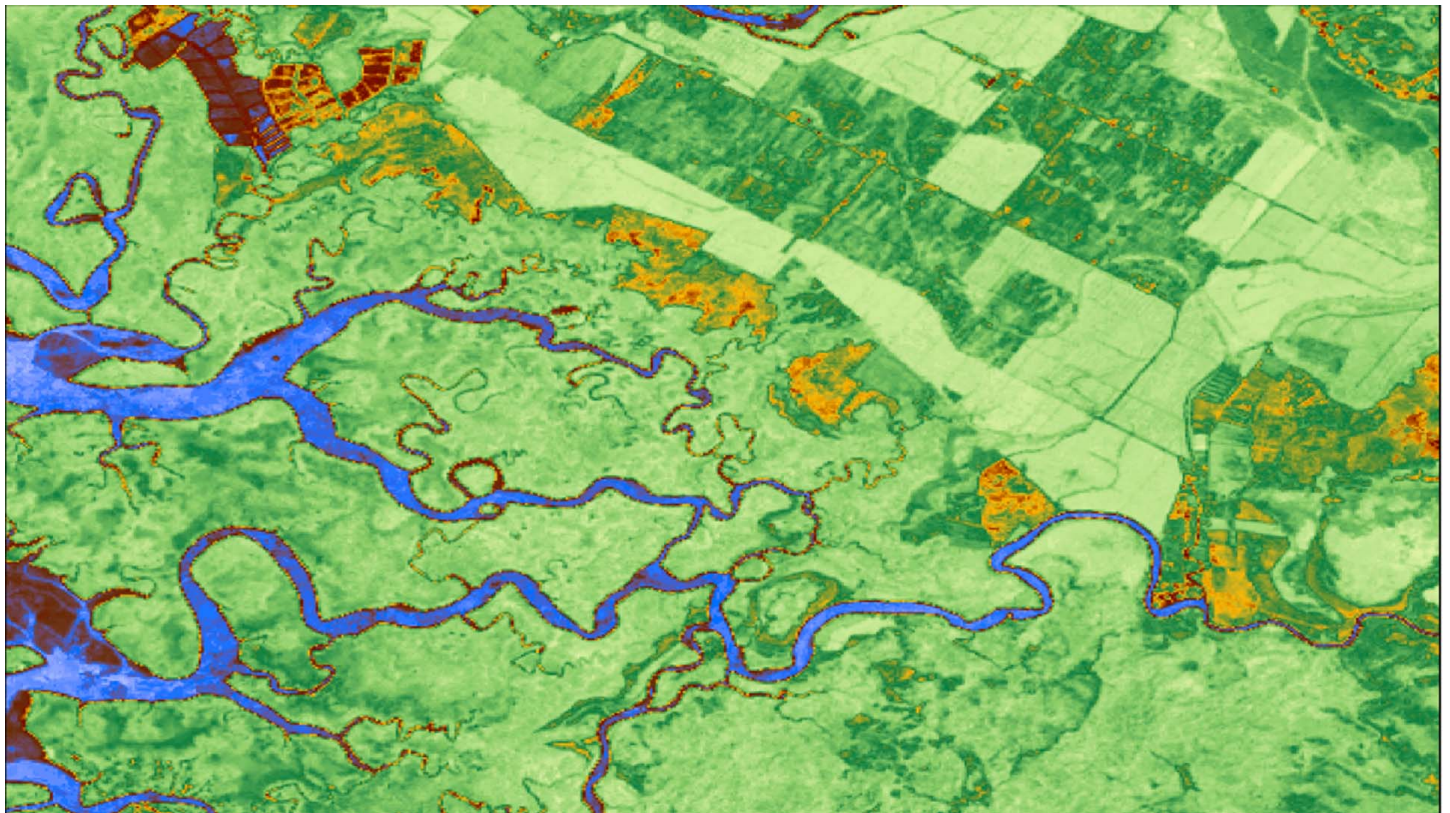

Land Use and Land Cover Changes



The Earth is constantly changing. Some of this change occurs slowly over many millennia, and some occurs relatively rapidly over the decades. Major natural forces cause such changes as volcanoes, continental shifts, building and erosion of mountains, reorganization of oceans, appearance and disappearance of deserts and marshlands, advances and retreats of great ice sheets, rise and fall of sea and lake levels, and the evolution and extinction of vast numbers of species.

Changes in Land Use

In addition to the changes brought about by natural forces, it has recently become apparent that a relative newcomer to planet Earth — the human being — has become a powerful agent of environmental change. The chemistry of the atmosphere has been significantly altered by the agricultural and industrial revolutions. The erosion of continents and the sedimentation of rivers and shorelines has been accelerated by construction, agriculture, and other human activities. The production and release of toxic chemicals has affected the health and distribution of plant and animal populations. The development of water resources for human use has affected patterns of natural water exchange in the hydrologic cycle (e.g., enhanced evaporation from reservoirs and irrigation as compared to that from unregulated rivers). As the human population grows and technology develops, the role of human beings as agents of global change will undoubtedly expand.

When Does the Earth's Surface Change?

Listed below are some of the ways in which natural forces can change the surface of the earth.

1. **Volcanoes**- A volcano is an opening on the surface of a planet or moon that allows material warmer than its surroundings to escape from its interior. When this material escapes, it causes an eruption. An eruption can be explosive, sending material high into the sky. Or it can be calmer, with gentle flows of material. These volcanic areas release lava, ash, gas, steam, rocks and other material. Over time those materials build up into mountains around the volcanic openings.



This photograph shows an eruption of Mount St. Helens in Washington in July 1980. This eruption sent ash 6 to 11 miles (10-18 kilometers) into the air, and was visible in Seattle, Washington, 100 miles (160 kilometers) to the north. Credit: Mike Doukas, USGS

2. **Erosion** - Erosion causes the earth to be worn away, often by water, wind or ice. A similar process, called weathering, breaks down or dissolves rock. Weathering also weakens rock or turns it into tiny fragments. No rock is hard enough to resist weathering and erosion. Together, weathering and erosion have shaped the landscape worldwide, from the sharp peaks of the Himalaya mountains in Asia and the spectacular rock towers of Bryce Canyon, in the U.S. state of Utah. In the image below, you can see how erosion caused by the Green River in Utah has changed the surrounding landscape over time.



April 22, 2018

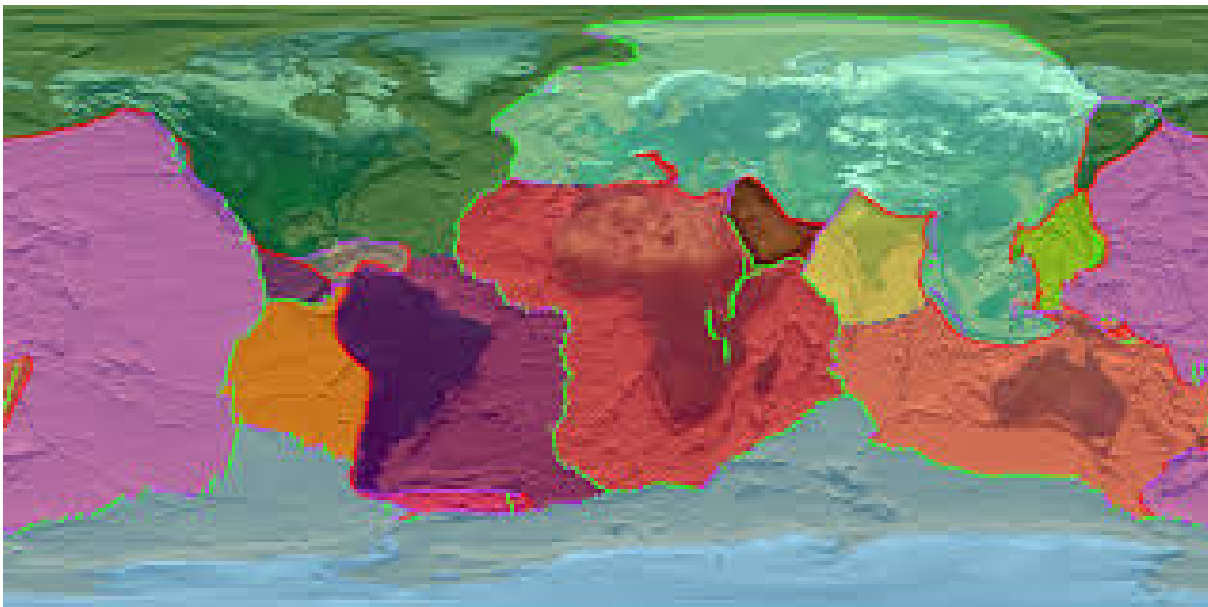
The portion of the Green River in this image is just north of Canyonlands National Park. Credit: NASA

3. **Landslides** - A landslide is the movement of rock, earth or debris down a sloped section of land. Landslides are caused by rain, earthquakes or volcanoes. Other factors can also make the slope unstable. Geologists, or scientists who study the physical formations of the Earth, sometimes describe landslides as one type of mass wasting. Mass wasting is any downward movement in which the Earth's surface is worn away. Mudslides, which move very quickly, are another type of mass wasting.



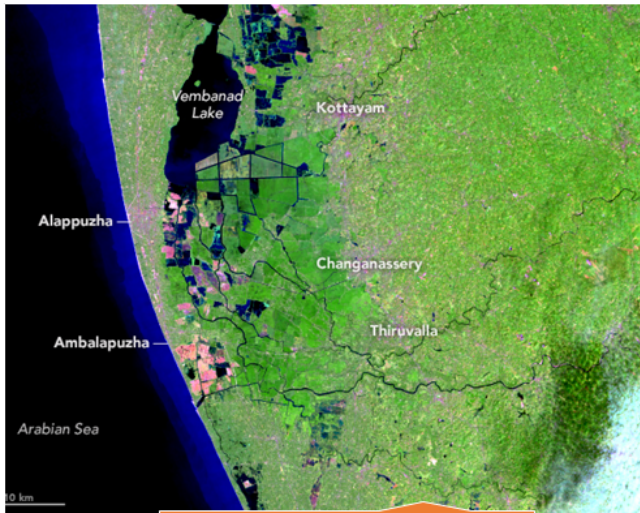
This landslide occurred on June, 1, 2007 on a mountain near Canmore in Alberta, Canada. The Flickr [photo](#) was taken by Sheri Teris ([Creative Commons](#))

4. **Continental Shifts** - The surface of the Earth, including continental landmasses, is broken into large pieces that are slowly shifting -- a gradual process called "plate tectonics." This slow voyage of the continents has reshaped the face of the Earth throughout its history.

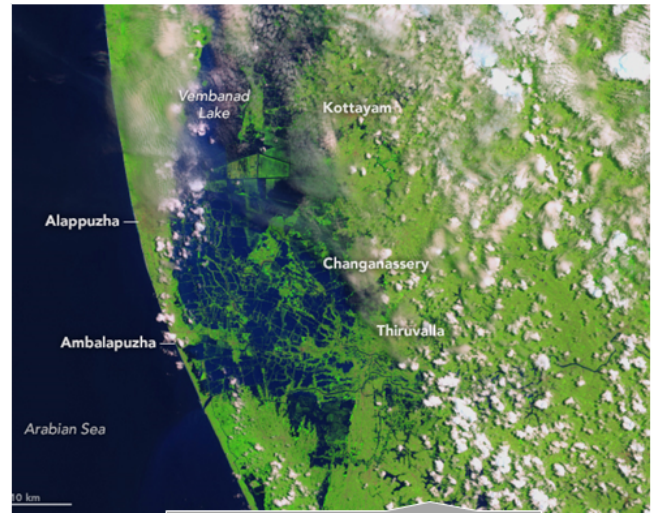


A combined image of the Earth's plates, plate boundaries, and ocean bathymetry. Credit: NASA SVS

5. **Flooding** - Floods are the most common natural disaster worldwide. For instance, the US Eastern and Gulf coasts are particularly vulnerable to storm surges from hurricanes, while the Northeast and North Central U.S., and some areas of the Western U.S. are more susceptible to excessive rainfall, snow/ice melt, and dam failures. The force of the water can sometimes move cars, buildings, and trees, erode the land, and damage crops. Pictured below are images from before and after India's state of Kerala experienced flooding.



Feb. 6, 2018

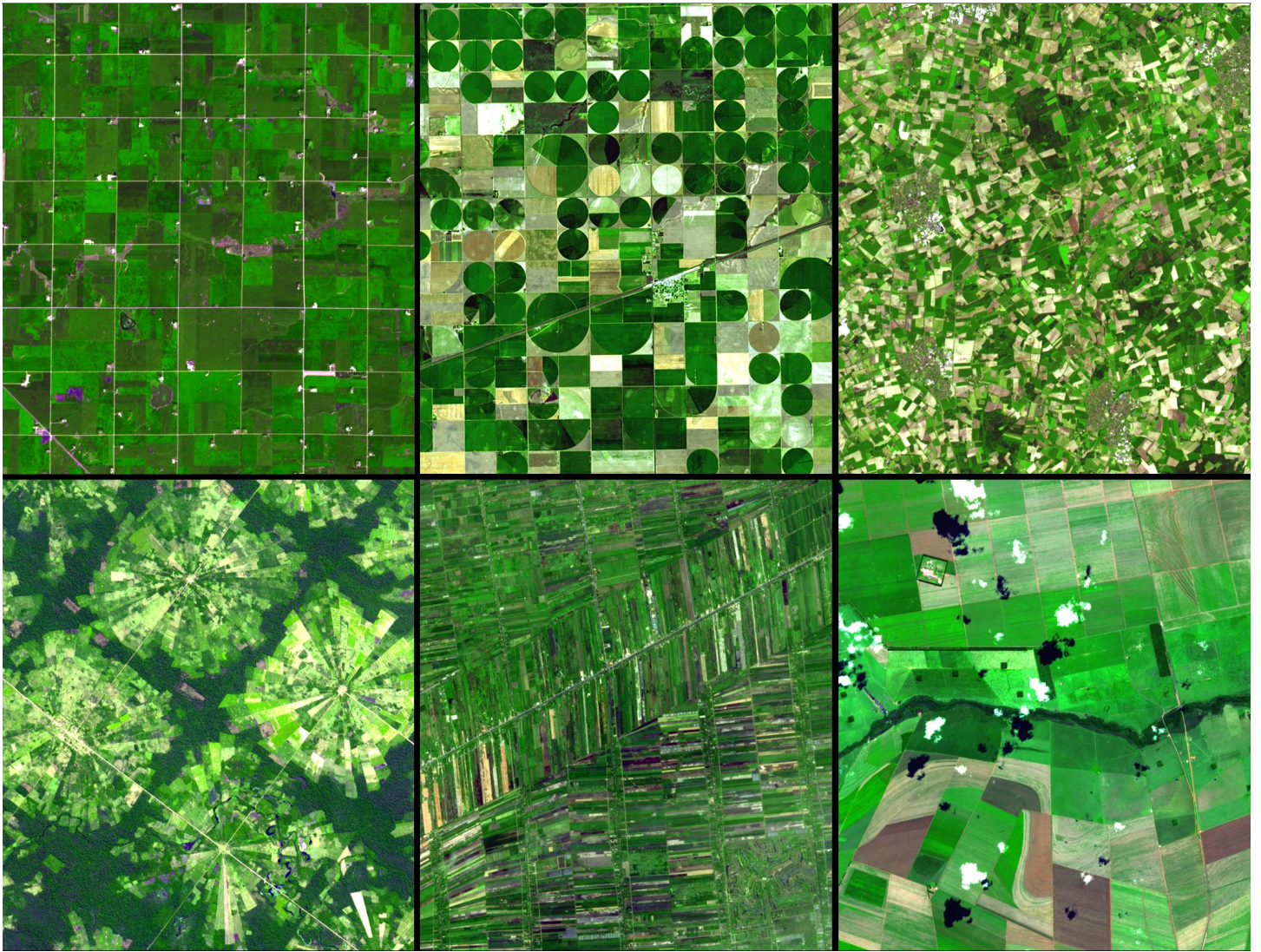


Aug. 22, 2018

Credit: NASA

6. **Human Influences** - Human presence across the face of the Earth is substantial and growing. Increasingly, from the perspective of outer space we can see the "fingerprints" of human presence on our landscapes. From the herringbone patterns of tropical deforestation, to the large square patches of agricultural fields, to the concrete splotches of urban sprawl, humans have attained the magnitude of a geological force as we reshape our environments. Scientists estimate that between one-third and one-half of our planet's land surface has been transformed by human enterprises. Listed below are a few of the ways humans have changed the surface of the earth.

- **Agriculture** - As the human population continues to grow and more societies develop modern economies, the rate of consumption is increasing globally. This results in more land being designated for agricultural use. Around the world, agricultural practices have developed as a function of topography, soil type, crop type, annual rainfall, and tradition. This montage of six images from the Advanced Spaceborne Thermal Emission and Reflection Radiometer ([ASTER](#)) sensor on NASA's [Terra](#) satellite shows differences in field geometry and size in different parts of the world.



Agricultural Patterns Credit: NASA Earth Observatory

- **Mining** - Another way in which humans change the landscape is by mining for minerals or coal. If you were to stand in the middle of the mines of Brazil's Carajás Mountains (Serra dos Carajás), the dusty red terrain could be mistaken for a Martian landscape. Yet in the images below, indicators of human presence are everywhere. Excavator trucks dig in the deep pits, while off-road trucks move hundreds of tons of ore along dirt roads. This is among the world's largest iron ore mining operations.



The red-brown earth exposed by open-pit mines contrast with the greens of the surrounding Amazon forest. Credit: NASA Earth, Landsat

- **Urban Development** - Each year humans destroy untold amounts of plants and fertile soil through the process of urbanization. Every time a subdivision is built, a strip mall is erected, or a road is laid, the local vegetation is uprooted and the soil is turned. Though new grass and trees may sprout afterwards, this newly grown canopy of vegetation is usually much less dense. The video below shows the increase of urban development in Las Vegas between 1972 and 2010

Where is land's surface changing?

Change is happening all around us all of the time. Change is the norm for the earth's natural systems, which are linked through interactive processes. Recently, humans have also become a key agent of this change. Changes to the earth's landscape can happen at global or local scales. It is important to remember that global change impacts all life, but even local changes can have global consequences.

Why Does NASA Study Land Cover/Use Change?

Landscapes change over vary of space as well as time, sometimes rapidly and other times quite slowly. These changes in the geosphere have important significant effects on the biosphere, including humans. NASA scientists study these changes using earth-observing satellites to better understand how these changes affect our planet and the vital aspects of habitat that we depend on to survive notably air and water quality, climate, food availability, and our health.

